

Structure–Fluorescence Relationships in Multichromophoric Protein Systems

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CV, publications and running projects be seen from [here](#) and [here](#).

Information about the research group can be seen from [here](#).

The PhD project will investigate how protein structure controls fluorescence and excited-state dynamics in multichromophoric protein systems, focusing on red algal phycobiliproteins: R-phycoerythrin (R-PE), R-phyocyanin (R-PC), and allophycocyanin (APC).

Although these proteins contain closely related bilin chromophores, they exhibit marked differences in fluorescence quantum yield. The structural origins of these differences remain insufficiently resolved.

The aim is to establish quantitative structure–fluorescence relationships by linking chromophore organization, protein architecture, and microenvironmental factors to radiative and non-radiative decay pathways.

Research questions

How does chromophore arrangement and coupling influence fluorescence efficiency and decay kinetics?

What role does the protein microenvironment play in modulating non-radiative relaxation?

How do subunit composition and higher-order structure affect energy transfer pathways?

Can predictive relationships be derived between structural features and photophysical outputs?

Research tasks

- **Protein isolation and purification:** Extraction and purification of native R-PE, R-PC, and APC from red algae while preserving chromophore–protein interactions.
- **Structural characterization:** Identification of subunits and chromophore binding sites using mass spectrometry and complementary methods.
- **Photophysical characterization:** Measurement of absorption/emission spectra, fluorescence quantum yields, and time-resolved decay kinetics.
- **Excited-state dynamics analysis:** Quantitative separation of radiative and non-radiative decay processes using time-resolved spectroscopy and kinetic modeling.

The main analytical/instrumental methods used in the project are: FPLC, HPLC, MS, NMR, spectroscopy, CD, X-ray crystallography.

Keywords: Phycobiliproteins, fluorescence, excited-state dynamics, energy transfer, protein structure–function, bilin chromophores

More information about Complex Systems in Natural Sciences PhD programme:

<https://www.tlu.ee/en/lti/complex-systems-natural-sciences-phd>